

**MISSOURI DEPARTMENT OF NATURAL RESOURCES
AIR AND LAND PROTECTION DIVISION
ENVIRONMENTAL SERVICES PROGRAM
Standard Operating Procedures**

SOP #: MDNR-FSS-204 EFFECTIVE DATE: 04/07/2004

SOP TITLE: Field Detection of Hazardous Atmospheres Using Combustible
Gas/Oxygen Detection Instruments

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SUMMARY OF REVISIONS: This is a complete revision of FSS-204 due to the
acquisition of new equipment.

APPLICABILITY: The procedures described in this SOP applies to all
ESP field personnel that may
be exposed to environments in which either an explosive
and/or oxygen deficient atmosphere may exist.

DISTRIBUTION: MoDNR Intranet
ESP SOP Coordinator

RECERTIFICATION RECORD:

Date Reviewed				
Initials				

1.0 SCOPE AND APPLICABILITY

The procedures contained in this document are applicable to ESP personnel who are tasked with determining the presence of combustible gas and/or oxygen deficiency in work spaces using an explosimeter (combustible gas indicator)/oxygen meter (CGI/O₂). The ESP is currently using three different models: the Gastechtor Model 1314 SMPN, the Biosystems PhD5, and the Thermo Gas Tech Innova.

2.0 SUMMARY OF METHOD

Explosimeter/Oxygen instruments are fully automatic, self-adjusting devices that give a characteristic warning signal when an alarm state exists. They can detect and indicate combustible concentrations in the sensitive parts per million (PPM) range, on up to the lower explosive limit (LEL) range, and also analyze for oxygen over a range of 0-25%. When preset levels of oxygen deficiency or the presence of gas are detected, they will give a warning signal.

These instruments are general survey instruments that may be used at waste sites and hazardous material spills.

These instruments are intrinsically safe for use in Class I, Group C and D atmospheres of combustible gas in air. Class I areas are those that have been made hazardous due to the presence of flammable gases and vapors. Group C includes the hazardous gases such as ethyl ether, ethylene, or gases or vapors of equivalent hazard, while Group D atmospheres include those such as acetone, ammonia, benzene, butane, cyclopropane, ethanol, gasoline, hexane, methanol, methane, natural gas, naphtha, propane, or gases or vapors of equivalent hazard.

An extension hose permits the taking of samples from specific points or enclosed spaces. Samples of the atmosphere under test are drawn continuously by means of an internal pump and analyzed for combustible gas on a heated catalytic platinum element. A solid-state amplifier is used to amplify indications of the catalytic element to give adequate voltage to drive the display and the alarm circuits. At the same time, the sample passes over an oxygen detector that gives an output in terms of percent oxygen, so every test for combustible gas is automatically accompanied by a test for oxygen concentration. If for any reason the oxygen reading should exceed 23%, an oxygen alarm is given to warn of a potential fire hazard. An alarm will also sound should the oxygen level fall below 19.5%. The normal level of atmospheric oxygen for Missouri elevations is just under 21%.

This SOP will discuss safety issues, proper instrument care, and other issues pertinent to the use of these instruments.

3.0 DEFINITIONS AND ACRONYMS

- CFR - Code of Federal Regulations
- CGI - Combustible Gas Indicator
- EER/FSS – Environmental Emergency Response/Field Services Section
- EPA - Environmental Protection Agency
- ESP - Environmental Services Program
- FID - Flame Ionizing Device
- HASP - Health and Safety Plan
- HAZWOPER - Hazardous Waste Operations and Emergency Response
- HSERP - Hazardous Substance Emergency Response Plan
- LEL - Lower Explosive Limit
- MoDNR - Missouri Department of Natural Resources
- OSC - On-Scene-Coordinator
- OSHA - Occupational Safety and Health Administration
- PID - Photo-ionizing Device
- PPE - Personal Protective Equipment
- PPM - parts per million
- Safety Officer - The person, generally the ESP sampler, who is assigned or assumes the duties of the health and safety officer for a specific investigation
- SOP - Standard Operating Procedures

4.0 HEALTH AND SAFETY WARNINGS

Due to the nature of the atmospheres and materials that may be tested and the fact that these materials may be highly flammable or toxic, extreme caution should be taken with respect to respiratory and explosion hazards. The following precautions should always be taken:

- 4.1 The level of personal protection required for conducting field testing shall be described in the site specific HASP and must be discussed in the site safety briefing by the Safety Officer. Personnel who enter a potentially explosive atmosphere must ensure that any non-intrinsically safe equipment (e.g., cell phones or pagers) is not taken into the hot zone
- 4.2 The explosimeter/oxygen meter should be used to check the ambient atmosphere for potentially explosive or oxygen deficient atmospheres.
- 4.3 Extremes of temperature and humidity may impact the explosimeter's ability to accurately read the ambient air conditions.
- 4.4 The explosimeter cannot distinguish individual chemicals. The instrument measures a range of flammability levels and a range of oxygen levels. Due to

the limitations of an explosimeter, a PID or FID should be used to monitor for non-flammable organics that may be present.

4.5 The instrument should be properly maintained and calibrated according to the manufacturer's specifications. See each instrument's instruction manual for specifics.

4.6 Appropriate personal protective equipment (PPE) should always be used.

5.0 PERSONNEL QUALIFICATIONS

All ESP personnel directly involved in field investigations at sites that fall under the EPA Worker Protection requirements of 40 CFR Part 311, referencing OSHA 29 CFR Part 1910.120, and meet the definition of HAZWOPER activities must:

- Attend a 40-hour course designed to meet the OSHA health and safety training requirements for hazardous site workers;
- Attend an annual 8-hour health and safety refresher course, or receive equivalent training;
- Participate in the department's medical monitoring program;
- Receive appropriate on-the-job training;
- Be familiar with the HSERP, written and maintained by the ESP; and
- Be familiar with the ESP SOP manual and have read all SOP documents that are applicable to the field activities, including, but not limited to, those referenced in this SOP.

6.0 PROCEDURE

6.1 Refer to the manufacturer's operations manual for specific instrument operations.

6.2 Each instrument will be calibrated or zeroed each day prior to use and information pertaining to the calibration will be recorded in the field log book. Calibration or zeroing, should be performed every 2-3 hours, when a significant environmental change (such as rain or temperature fluctuation) occurs, or if the instrument fails to zero.

6.3 The battery should be charged, and the instrument should be kept clean. Liquids should not be allowed to enter into the sample tube. Allow several minutes for warm-up before use. Each instrument will begin to display values or give an audible sound when ready.

7.0 OPERATION

7.1 Model 1314 SMPN Gastechtor Instructions

- 7.1.1 Connect the hose and the probe to the fitting on the front of the instrument. Be sure that the probe inlet is in a gas-free area.
- 7.1.2 Press the POWER switch to turn the instrument on.
- 7.1.3 Press the LEL/PPM button to the LEL mode; the red light activates; the read out display will blink on and off.
- 7.1.4 After the warm-up period has elapsed, the buzzer will sound once and the display will continue to blink.
- 7.1.5 IN FRESH AIR: Press and release the ADJUST button (a double “acknowledge” tone will sound).
- 7.1.6 IN FRESH AIR: Press and hold the ADJUST button for seven (7) seconds. The alarms are now enabled and the instrument is now ready for normal operation.
- 7.1.7 The instrument takes continuous readings as it draws ambient air through the sample hose.
- 7.1.8 Read the display screen for values observed.
- 7.1.9 Press the POWER switch to turn the instrument off.

7.2 Biosystems PhD5 Multi-Gas Detector Instructions

- 7.2.1 Press the circular push button on the top of the PhD5 case; the MODE button. The machine will automatically go through an electronic self-test and start up sequence that will take approximately thirty (30) seconds. Be sure that the instrument is in a gas-free area.
- 7.2.2 The instrument is now ready for use.
- 7.2.3 Read the display screen for values observed.
- 7.2.4 The instrument takes continuous readings as it draws ambient air through the sample port.
- 7.2.5 Press the MODE button to turn the machine off.

7.3 Thermo Gas Tech Innova Instructions

- 7.3.1 Press the ON/OFF button for one (1) second to turn it on. Be sure that the instrument is in a gas-free area.
- 7.3.2 When the warm-up is complete, the buzzer will beep, lights will flash several times, and the display will read "WARM UP COMPLETE".
- 7.3.3 Hold down the AIR button for three (3) seconds until the display counts down and the bar graph starts to scroll, then the display will read "DONE".
- 7.3.4 The instrument is now ready for use.
- 7.3.5 Read the display screen for values observed.
- 7.3.6 The instrument takes continuous readings as it draws ambient air through the sample port.
- 7.3.7 Press and hold the POWER button for three (3) seconds to turn the machine off.

8.0 Sensor Zeroing:

8.1 Model 1314 SMPN Sensor Zeroing:

- 8.1.1 Zeroing is done automatically when the ADJUST button is pressed.
- 8.1.2 No other field calibration is necessary.

8.2 Biosystems PhD5 Multi-Gas Detector Sensor Zeroing:

- 8.2.1 Turn the instrument on and make sure that gas readings are given in numbers. (This is an indication that the PhD5 is currently in Basic, Basic/ Peak, or Technician Mode).
- 8.2.2 Wait at least three (3) minutes after turning the instrument on to allow sensor readings to stabilize fully before initiating any calibration procedures.
- 8.2.3 Make sure the instrument is located in an area where the air is known to be fresh.

8.2.4 Press the MODE button three (3) times within two (2) seconds. This will activate the screen which will display the message “One Button Auto-Calibration”.

8.2.5 The instrument will begin a five (5) second countdown. Press the MODE button within the five (5) second limit.

8.2.6 The instrument is now zeroed.

8.3 Thermo Gas Tech Innova Series Sensor Zeroing:

8.3.1 In a gas free environmental turn on the instrument and allow it to cycle to the “WARM UP COMPLETE” mode.

8.3.2 IN FRESH AIR: Press and hold the AIR button for three (3) seconds.

8.3.3 No other zeroing is necessary.

9.0 QUALITY ASSURANCE AND QUALITY CONTROL

9.1 Although explosimeters are not normally used for quantitative data, the instrument should be calibrated using the appropriate method for each individual instrument prior to each use. If the compound being monitored is known, quantitative data can be inferred based on the compound's explosive range. However, it is very unusual when only one compound is encountered in a field situation, making quantitative data very unreliable.

9.2 Calibration data should be recorded in the field notebook (see *MDNR-FSS-004 Field Documentation*) and available for review.

10.0 REFERENCES

- MDNR Field Services Section Standard Operating Procedure *MDNR-FSS-004 Field Documentation*
- Model 1314 SMPN Gastechtor Instruction Manual
- Biosystems PhD5 Multi-Gas Detector Instruction Manual
- Thermo Gas Tech Innova Series Instruction Manual
- HSERP



Thermo Gas Tech Innova



Biosystems PHD5 Multi Gas Detector